# KNOWLEDGE

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# SHIPPING (part one)

SHIPS THROUGH THE AGES

*An Egyptian ship of about 3000 B C*

*A Greek ship of the 4th century B C*

*A Roman trireme of the 3rd century B C*

*A Viking ship of the kind used in about the 9th century A D*

THE GREAT CITIES OF THE ANCIENT WORLD WERE MOSTLY ON THE COAST, AND SO COULD TRADE WITH EACH OTHER BY SEA

*In the ancient world trade was often on a barter basis. Where ports did not exist the cargoes were exchanged on the beach*

SINCE primitive man first sat astride a floating log ships have been used for communication, for commerce, and for conquest. The peoples of the ancient world soon became proficient shipbuilders, turning the Mediterranean Sea, the centre of their world, into a highway and frequently into a battlefield. In turn the Egyptians, the Cretans, the Phoenicians, the Greeks, the Carthaginians, and the Romans were supreme on the sea, each nation sailing farther abroad than its predecessor and adding more to man's knowledge of the world. The Phoenicians had trading galleys in the Red Sea, and the Carthaginians sailed westwards through the Straits of Gibraltar and north to the Cornish coast. Some may even have circumnavigated Africa.

The Mediterranean peoples were not alone in building ships. The Norsemen ploughed their way from Scandinavia across the North Sea to Britain and across the Atlantic to the east coast of North America.

*A three-masted ship of the 15th century*

*A single-masted ship of the 13th century*

*A carrack of the 15th century*

*16th-century Portuguese man-of-war*

*Merchantman of the 18th century*

*Previous page:* A flotilla of 15th-century three-masted Spanish ships.

# NORTH AMERICA: mountains, plains, and rivers

WHEN the first Europeans landed in North America some 500 years ago they settled on the east coast. Gradually they explored the interior of the continent, working westwards. It was not an easy country to explore. First they had to find their way through the Appalachian Mountains in the east; then they had to cross immense plains, dropping first to the Mississippi and then rising to the Rocky Mountains; and once they had passed the Rockies they still had to cross several hundred miles of ranges and valleys before they reached the Pacific coast. In some places they explored the continent by sailing up the rivers which ran through it.

*Europe: fold mountains running east-west*

*America: fold mountains running north-south*

The two small maps above show the main fold mountain lines of Europe and North America marked in red. In Europe the young (geologically speaking) Alpine folds and the North European plain run from east to west. In North America, however, the very ancient Appalachian Mountains and the younger Rockies run more nearly north to south, confining the Central Plains between them as a corridor opening on to Hudson Bay and the Gulf of Mexico.

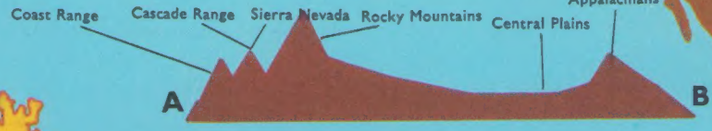
## THE FOUR MAIN ZONES OF NORTH AMERICA

1. **The Eastern Mountain Zone,** which runs from the St Lawrence River in Canada to Georgia in the southern United States. The various mountain ranges, which are grouped together as the Appalachians, run roughly parallel to the coast. In the north they stretch east to the sea, but from New England southwards there is a widening coastal plain.

2. **The Canadian Shield,** a region of very old, tough rocks which have been worn down by wind, ice, and rain into an undulating plain, dotted with lakes. This zone includes over half of Canada. It is shaped roughly like a horseshoe, with Hudson Bay at its centre. The islands off the north coast of the continent, including Greenland which belongs to Denmark, present a landscape similar to that of the Canadian Shield.

*The four zones into which North America can be divided*

*(Right) Cross-section of America from two points A and B (see below)*




3. **The Central Plains,** which run like a corridor down the centre of the continent between the mountain zones. These plains are immensely varied, ranging from the high Great Plains which border the Rockies on the eastern side and are between 2,000 and 6,000 feet high to the Everglades of Florida, a sub-tropical region which lies only just above sea-level.

4. **The Western Mountain System,** made up of many mountain ranges, running predominantly north-south, with intervening plateau regions. This is the longest of the four zones, as it runs all the way down the continent from the very north of Alaska to southern Mexico.

*The highest point in North America: Mount McKinley in Alaska (20,320 feet)*

*The vast mangrove swamp of the Everglades National Park in Florida; a sanctuary for millions of water-loving birds*

*Colossal icebergs drift on the fringes of the Alaskan coast in summer*

## THE EASTERN MOUNTAIN ZONE

The first barrier which the early settlers had to cross as they moved westwards was the Appalachian Mountains which stretch some 1,600 miles nearly parallel to the east coast. In the north the east-facing slopes are almost unbroken and proved a serious obstacle to travellers and later to the construction of railways, but south of New York the mountain ridges are broken enough to allow travellers to cross them.

At the time of the early settlers Indians lived in the forest-covered ranges, and although many trees have since been felled there are still hundreds of miles of oaks, birches, maples, and conifers. The National Parks of Shenandoah and Great Smoky Mountains, and many forest regions, are visited by countless people each year on their holidays.

The Appalachians also contain valuable minerals, including anthracite, bitumen, petroleum, natural gas, and iron. These have led to the foundation of industries like the great iron and steel works of Pittsburgh.

Among the many different ranges which are grouped together under the name Appalachians are: the Alleghenies to the west, which slope down to the Central Plains; the Catskill Mountains in New York State; the Cumberland Plateau at the mountains' southwest tip; and the Black Mountains of North Carolina, which include Mount Mitchell (6,684 feet), the highest in the Appalachians.

*Lands with less than 20 inches of rain a year*

*Lands with more than 20 inches of rain a year*

## THE CENTRAL PLAINS

A plateau, slightly tilted towards the Mississippi, slopes down from the Allegheny Mountains to the Ohio River; this is the eastern boundary of the central lowland plains, a vast area of slight relief. A long growing season, a favourable amount and distribution of rainfall, and a fertile soil have made it one of the best agricultural regions of the world.

The natural vegetation of long grasses and trees has now been replaced by huge farms and estates growing tobacco and cotton, maize (or corn as the Americans call it), wheat, and barley. Rainfall gradually decreases towards the west, and cultivated farmland is replaced by open grazing lands of the 'Great Plains', west of the latitude 100°W. These plains slope imperceptibly upwards to heights of over 5,000 feet at the eastern base of the Rocky Mountains.

In the 'corn belt' of the upper Mississippi valley temperatures are extreme, ranging from −15°F in winter to above 100°F in summer. The corridor shape of the Central Plains means that cold winds from the north and warm winds from the Gulf of Mexico bring rapid changes of temperature to cities like Minneapolis, Chicago, and St Louis.

## THE CANADIAN SHIELD

The Canadian Shield, also called the Laurentian Shield, is one of the oldest parts of the earth's surface. The south of this vast region is covered with dense coniferous forest which changes in the north into mossy tundra vegetation. The whole area is dotted with marshes and lakes, the biggest of which are the Great Slave Lake and the Great Bear Lake, both in Canada's frozen Northwest Territories.

*The land west of the red line has an annual average of less than 20 inches of rain. This means that enough rain for crops cannot be relied on*

*The arid desert of Colorado, with its flat-topped hills, pillars of rock, and cacti*

Although the Canadian Shield is rich in minerals and timber, conditions are so unpleasant, with intense cold in winter and plagues of mosquitoes in summer, that it is largely undeveloped except for mining, fur trapping, and lumber towns.

The Laurentian Mountains form the eastern edge of this Shield, running north of the Ottawa River and the St Lawrence valley. In the south the Canadian Shield dips into the United States with the Adirondack Mountains.

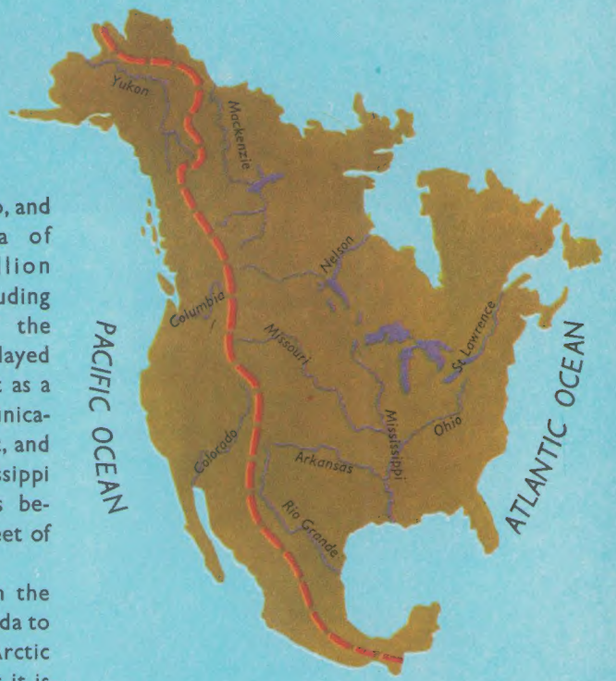
## THE WESTERN MOUNTAIN SYSTEM

All the lands west of the Great Plains are included in this zone of North America, the most outstanding feature of which is the Rocky Mountains. We have already looked at this region in some detail in two earlier articles: **The Rocky Mountains** (see page 648) and **The West of North America** (page 942). The highest peak in North America, Mount McKinley (20,320 feet) in Alaska, is in this region.

## RIVERS

North America has many large rivers, which play an important part in transport, irrigation, and supplying hydroelectric power.

The main river of North America is the Mississippi-Missouri, which is about 3,900 miles long and is the third longest river in the world. It flows from the Rockies to the Gulf of Mexico, and drains an area of nearly 1¼ million square miles, including 40 per cent of the United States. It played an important part as a means of communication in the opening up of the West, and during the 19th century the Mississippi carried many boats. It discharges between 600,000 and 700,000 cubic feet of water per second.



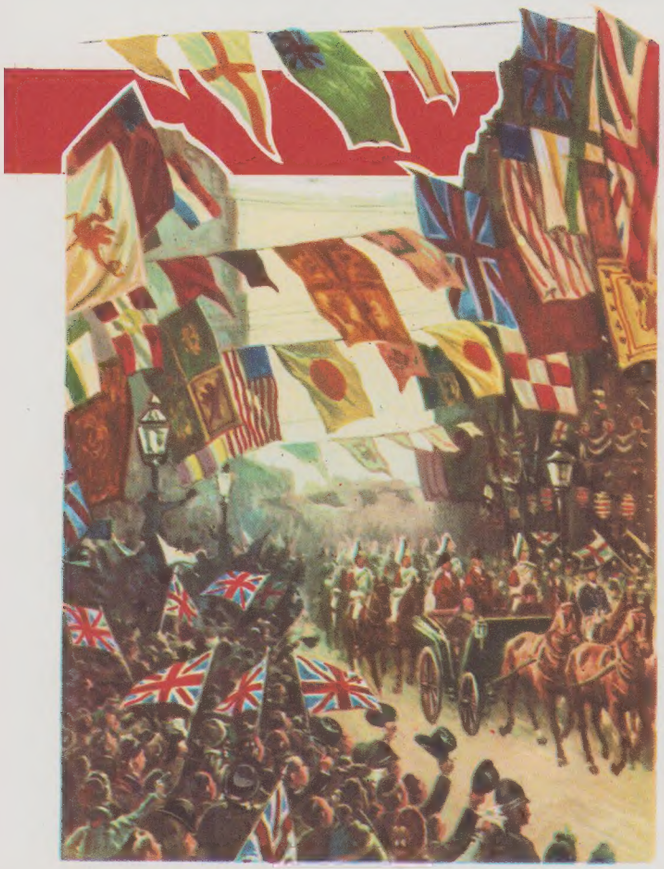

*A map of North America showing the main watershed (marked in red) from which many of the main rivers flow. They drain into the Atlantic and Arctic Oceans, and smaller ones flow into the Pacific*

The Mackenzie River flows from the Great Slave Lake in northern Canada to the Beaufort Sea (part of the Arctic Ocean). With its major tributaries it is 2,514 miles long – the second longest river in North America. About 2,000 miles of it are navigable. It drains much of the eastern side of the Rockies and the lakes of the western edge of the Shield. As in the other northern rivers, its upper reaches melt first in the spring thaw, causing considerable floods.

Another great North American river is the Yukon, which flows for nearly 2,000 miles through northern Canada and Alaska to the Bering Sea. At the end of the 19th century it was a major transport route to the mines during the Klondike gold rush.

Two large rivers flow west from the Rockies to the Pacific: the Columbia (1,200 miles) rises in British Columbia and drains 259,000 square miles, mostly in the United States; the Colorado rises in Colorado State and flows south-west through Utah and Arizona to the Gulf of California, cutting magnificent gorges into the Colorado Plateau, the most famous of which is the Grand Canyon. Ample supplies to its headwaters enable it to maintain its course through desert country.

Other large North American rivers include the Nelson River, which flows from Lake Winnipeg to Hudson Bay; the St Lawrence, which has been described on page 369; and the Rio Grande, which forms the international boundary between the United States and Mexico for about 1,300 miles of its 1,800-mile journey between the mountains of south-west Colorado and the Gulf of Mexico.



*22nd June 1897 – Queen Victoria's Diamond Jubilee. Cheering crowds line the royal route to greet the sovereign who has reigned over them for 60 years*

# QUEEN VICTORIA

QUEEN VICTORIA reigned longer than any other sovereign in English history. She also reigned during the very greatest days of the British empire: when her nation had a decisive voice in world politics; when her subjects were treated with awe and respect wherever they showed her flag; and when her country was the 'workshop of the world'.

It is not difficult to see why Victoria's reign has made such an impression upon posterity. Apart from witnessing the heyday of the British empire, it saw many of the greatest of 19th-century figures – Dickens, Thackeray, Wordsworth, Tennyson, the Brownings, Shaw, Wilde, Elgar, and countless more. At one end Victoria's reign coincided with Melbourne, Peel, and the Duke of Wellington; and she died in the age of Joseph Chamberlain, Herbert Asquith, and Keir Hardie. In between came the summits of the careers of the most illustrious of statesmen – Palmerston, Disraeli, and Gladstone.

Yet in an age of great men and great events Victoria herself did great things. She raised the popularity of the monarchy from the depths to which it had sunk in the reigns of her predecessors, the disreputable George IV and eccentrically vulgar William IV. She established herself in the affections of her subjects, and she set the very standards of her age in such things as 'Victorian' table manners, a large 'Victorian' family, and 'Victorian' prudery.

## A Whig youth

Victoria did not really regard herself as a Hanoverian. She was almost completely isolated from the family of her father, the Duke of Kent, and was brought up largely by her mother, the homely and impoverished Mary Louisa Victoria of Saxe-Coburg-Gotha. After her accession in June 1837 she became increasingly independent and even banished her mother to a distant set of apartments once the family was installed in Buckingham Palace.

The idea of an 18-year-old girl queen fired the popular imagination, but Victoria soon forfeited that popularity. She relied excessively on Lord Melbourne, the Whig leader, to whom she became extraordinarily attached. She cut herself off from the Tories, and over the 'bedchamber crisis' (see page 2600) it was virtually her decision which resulted in Melbourne taking office instead of the Tory leader, Peel. This alarmed many who thought she was abusing her constitutional rights.

It should be remembered that in Victoria's reign the Crown still had a great deal of political influence. If the sovereign exerted her rights to the full she could, in fact, disrupt the smooth workings of the constitution. Gradually Victoria came to realise that it was her duty to be neutral between Whigs and Tories, though she remained politically active and influential. For example, she had much to do with Palmerston's dismissal from the Foreign Office in 1852 and Aberdeen's appointment as Prime Minister the same year. But eventually even this kind of interference disappeared. In the days when she detested Gladstone and adored Disraeli she just had to accept that the age had passed when the sovereign could choose the ministry she wanted.

The change from a headstrong to a sensible queen was largely the result of Victoria's marriage in 1840 to Prince Albert of Saxe-Coburg-Gotha. Soon she fell under his spell. He taught her the merits of hard work. He hated London and late parties, and the Queen adopted his tastes. The Duke of Wellington said the Prince was 'extremely strait-laced and a great stickler for morality, while she was rather the other way'. She even came to like the austere Robert Peel.

*A splendid reign begins. The young Queen Victoria is crowned in Westminster Abbey on 28th June 1838*

*The 18-year-old Queen Victoria*

## A neutral middle age

Thus the Queen, blissfully content in a new role, left much royal business to Albert and settled down to having children. The royal pair became the symbol of Britain and of British virtues – hard work and moral principles. It was an idea of Albert's which resulted in the Great Exhibition of British manufactures in 1851 (see page 14). This exhibition brought great prestige, both for industry and for the monarchy.

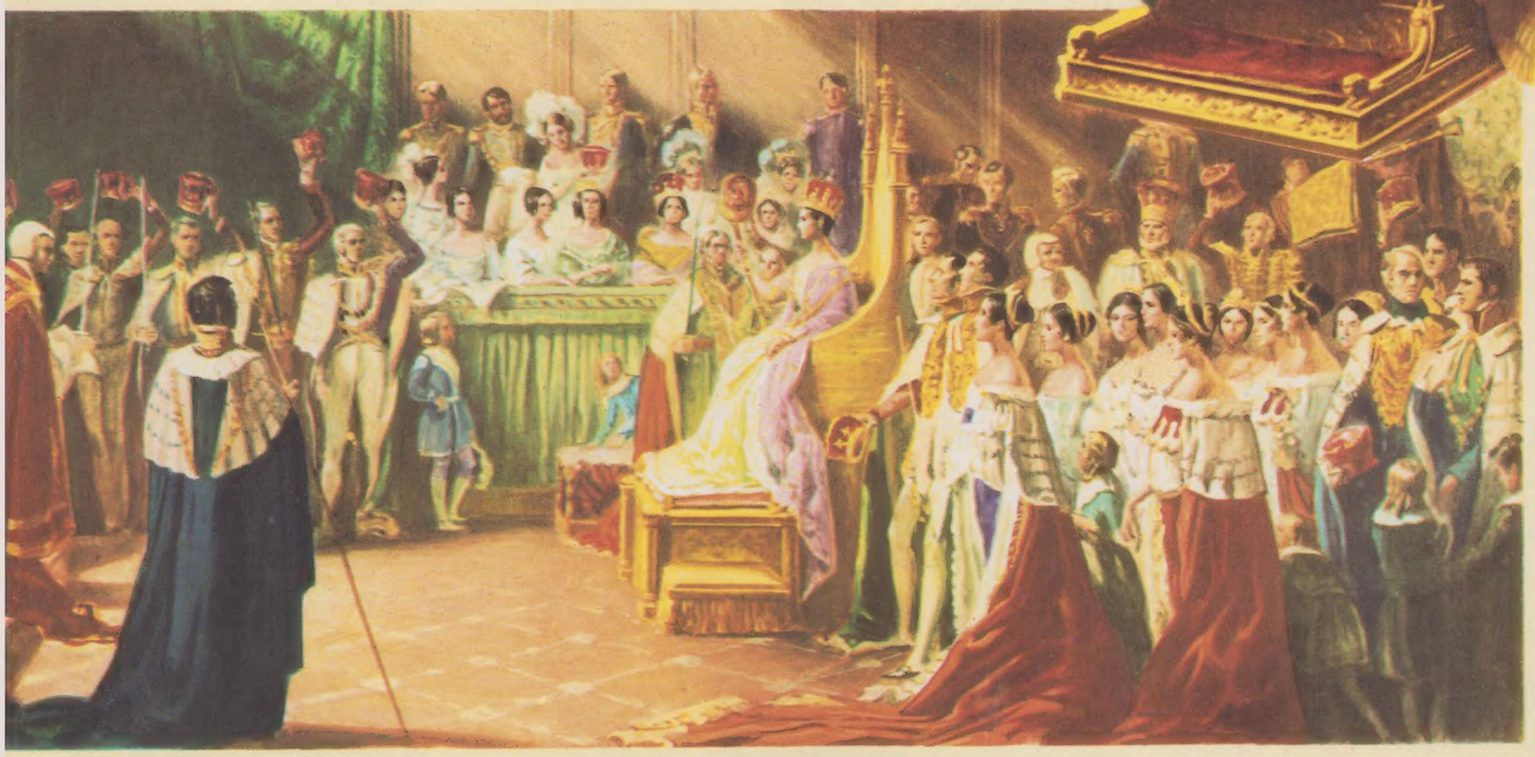
Victoria's middle years were happy and fruitful. The monarchy gained still further popularity during the Crimean War, in which the Queen – an enthusiastic supporter of the work of Florence Nightingale – instituted the Victoria Cross for gallantry. Then, in 1861, tragedy struck. Her beloved Albert died, leaving her a widow of 42 with nine children. She disappeared into a long period of profound mourning, and the wave of public sympathy shortly gave way to irritation at the Queen's 'retirement' and neglect of her duties.

*Prince Albert – beloved husband of Queen Victoria*

*1876 – the Empress of India on her Imperial throne*

## A Tory widowhood

It was Disraeli who rescued the Queen from her far-from-splendid isolation. It is not hard to see why the distraught Queen, nostalgic for all she had lost, distrustful of anything new, should have preferred the conservatism of Disraeli to the radicalism of Gladstone. But there was also a very strong personal element in her relationship with Disraeli. He flattered, almost wooed, her. His letters to her were gay and gossipy, while Gladstone's were lengthy and tedious. Under Disraeli's influence she came out of her seclusion and took her place as the triumphant symbol of a resurgent British empire.



Victoria took readily to Disraeli's 'Tory democracy' (see page 1580). She loved his emphasis on the prestige of the Crown and the strength of the empire. She was delighted by his purchase of the Suez Canal shares in 1875, and his master-stroke in proclaiming her Empress of India in 1876.

After Disraeli's death in 1881 Victoria remained a 'conservative'. She staunchly supported the House of Lords, and reproved Gladstone for many of his policies, particularly those in favour of Home Rule for Ireland. She wrote to friends complaining about him. But she could not dismiss him. Political power had passed almost completely to the electorate, especially after the widening of the franchise (increasing the number of voters) in 1867 and 1884. Even if she did not fully understand this, it remained a fact that her political power was declining even as she reigned.

As might be expected, Victoria's last years were spent once more in partial seclusion. Her jubilee years in 1887 and 1897 were glittering occasions of great public rejoicing. But her contact with her ministers grew less frequent. Yet, unlike in her earlier retirement, she was never more revered than in those last years. Everyone, including her obstreperous son Edward, Prince of Wales, stood in awe of her. Her household chambers became legendary. She lived a strange, remote life, surrounded by souvenirs of her past. No one knocked on her door, for only a faint scratching was permitted. Every morning in Windsor her beloved Albert's clothes were laid out and his basin filled with fresh water; she slept beneath a photograph of his head and shoulders – a photograph taken as he lay dead.

When she died on 22nd January 1901 Victoria had enjoyed a momentous reign. Behind all the vast changes it had witnessed had stood her character – honest, simple, austere, with a massive devotion to duty and a high sense of responsibility. Her personality stamped her age, and 'Victorian Britain' passed deeply regretted by those who sensed the years of instability and insecurity that were to follow.

# DAY-TIME AND NIGHT-TIME

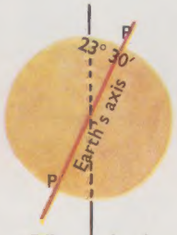
MAN has always measured the passing of time in days and nights, the alternating periods of light and darkness which envelop the earth with unfailing regularity. The rhythm is unchanging – light then darkness, day and night – and we respond to this rhythm in our waking and our sleeping; plants and animals respond to it, too, often more closely because of the difference in temperature involved between day and night. What causes this regular rhythm to continue, predictable to the second, from year to year? And why is it that while in Britain it is night it is midday in the islands of the Pacific, and while it is sunset in New York it is sunrise in India?

## The shape and position of the Earth

Before these questions can be answered it is first necessary to look briefly at the shape and position of the Earth.

*The Earth is shaped like a sphere very slightly flattened at the two poles (P)*

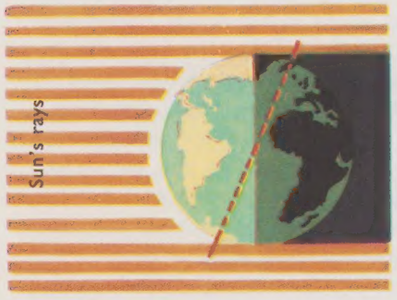
*We can imagine a line which joins the two poles; this line is the Earth's axis*




*The axis is not perpendicular in its plane of orbit, but inclined at 23½°*

## If the Earth stood still

The Earth is exposed to the rays of the Sun and, because of its spherical shape, it is lit by them over half its surface. In the half exposed to the Sun's rays it is day; in the other half, which is in shadow, it is night. If the Earth stood still, one half of the globe would be perpetually exposed to temperatures far too high for human life; the other half would be covered in permanent ice-caps. Men could only live in the twilight zone between; in this the Sun would always be low on the horizon, although it would never set. But, as we know, this is not the case; day and night continually succeed one another. Why?

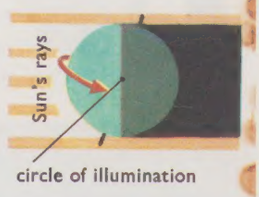



*If the Earth stood still, one hemisphere would always be lit up, the other dark*

## But the Earth moves

The succession of day and night comes about because the Earth is always turning on its own axis (see page 1966). Thus each country is continually brought from light to shade and back to light again. This movement is called *rotation*, and its direction is from west to east (the opposite direction from that in which the Sun, Moon, and stars appear to rise and set). Any point on the Earth's surface rotates in approximately 24 hours – one day.

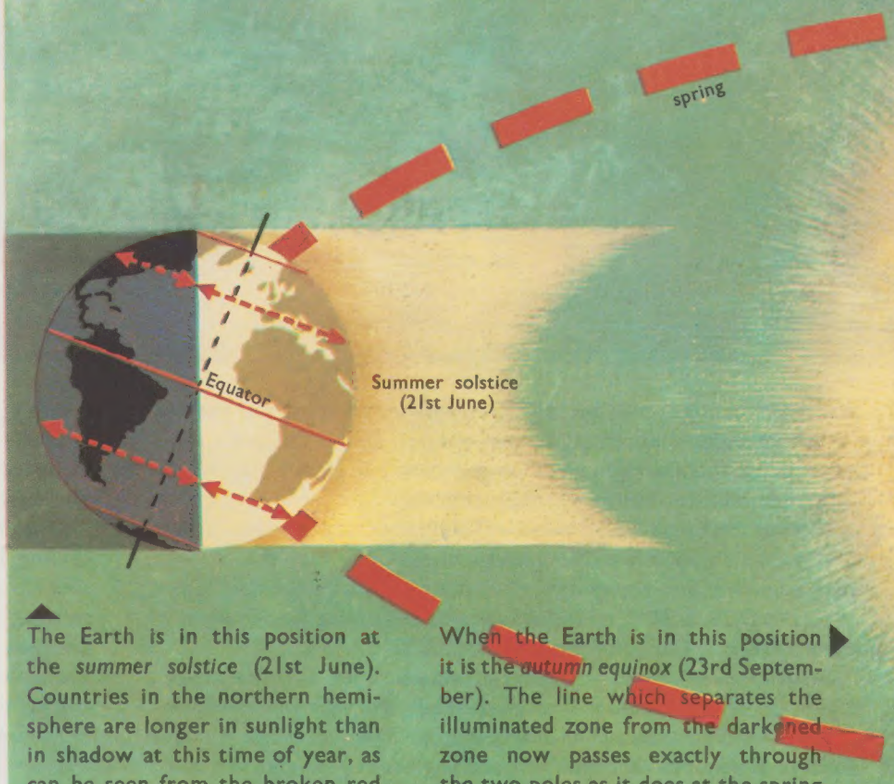
The circular line which separates the illuminated hemisphere from the one in darkness is called the *circle of illumination*. Each day every point on the globe is swept over twice by this circle – at dawn and at sunset.




*The Earth turns on its axis; the direction of rotation is from west to east*

## THE DURATION OF DAY AND NIGHT

We know that the Earth moves in another way (see page 1978) – it revolves around the Sun. But during this second movement it always keeps its axis at the same angle of inclination in its plane of orbit, and the direction of the inclination does not change. It is this constant inclination of the Earth's axis which causes night and day to have different lengths in the two hemispheres. It also means that lands within the Arctic and Antarctic circles have 24 hours' daylight in summer and constant darkness in the depths of winter.




The Earth is in this position at the *summer solstice* (21st June). Countries in the northern hemisphere are longer in sunlight than in shadow at this time of year, as can be seen from the broken red line running through part of Europe and North America. This means that the day is longer than the night in the northern hemisphere, while in the southern hemisphere the converse occurs.

When the Earth is in this position it is the *autumn equinox* (23rd September). The line which separates the illuminated zone from the darkened zone now passes exactly through the two poles as it does at the spring equinox (see above). The duration of day and night is exactly the same for countries in the northern hemisphere as for countries in the southern hemisphere. And day and night have the same length – 12 hours.

① ②

This half of the world is illuminated because it is facing in the direction of the Sun.

For all the countries which are in this part of the globe it is day; on the other side it is night. Imagine the globe turning in the direction of the arrow; sunset will occur on the east side of Africa before the west. Compare the position of Europe now with its position in the first diagram. The Earth has now completed one-quarter of its revolution; the part which first was in darkness has now revolved towards the Sun and is lit up. Europe, which was in the daylight, is now in the darkness of the night.

## DAWN AND SUNSET

Since every region of the Earth at a certain point of its rotation 'turns its back' to the light and enters the shadow (and vice versa), why do we not notice this in a striking manner? Why do we not pass from light to darkness and from darkness to light in one moment? This is because of the atmosphere which envelops the Earth and ensures that the change is gradual.

Before the Sun itself appears above the horizon its rays are seen; they are refracted, or scattered, by the atmosphere, and so we see something of them before we see the Sun itself – at dawn.

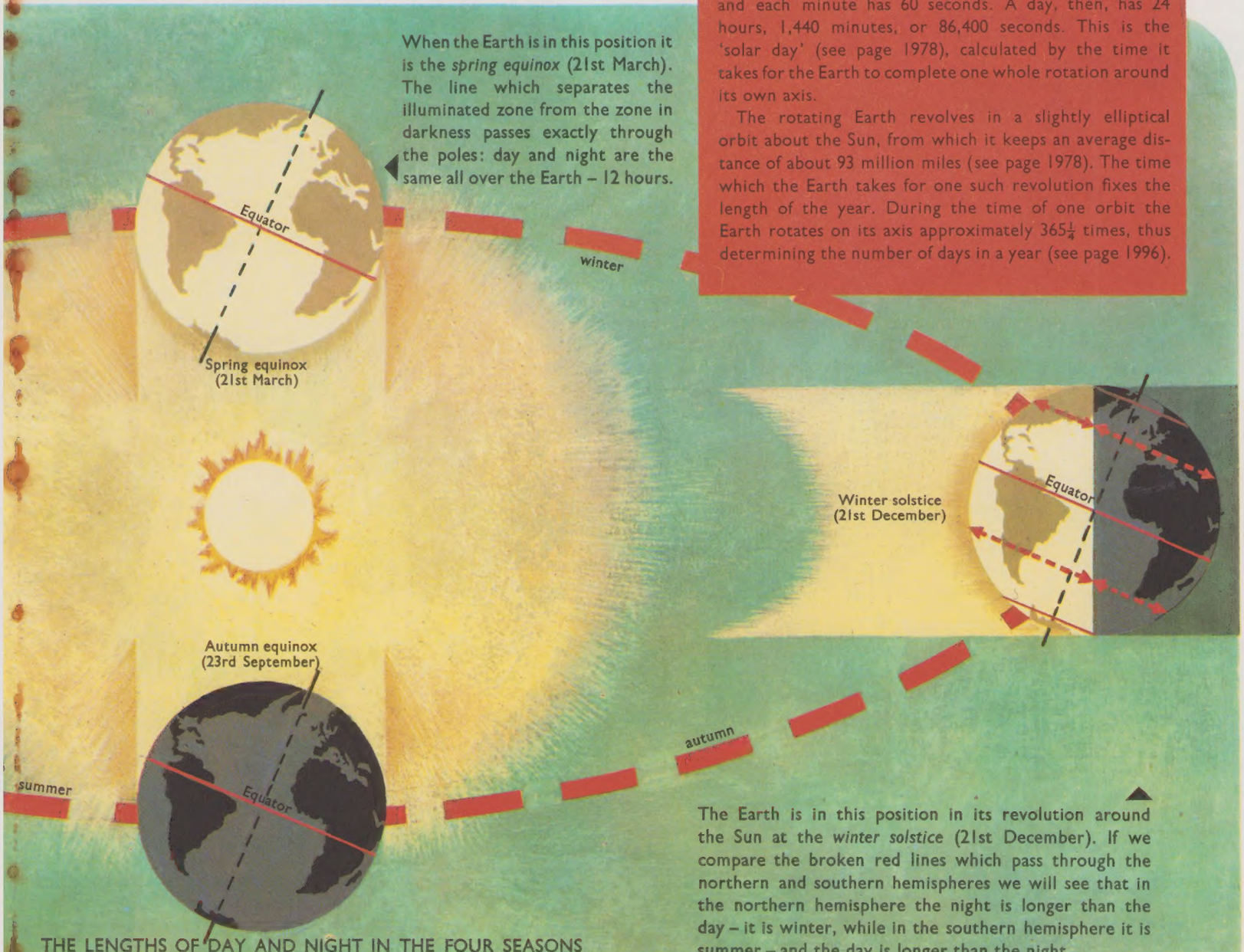
At sunset, too, when the Sun has already set below the horizon, its refracted rays – in many colours – can still be seen in the atmosphere.

## THE SOLAR DAY AND THE SOLAR YEAR

The day is divided into 24 hours: each hour has 60 minutes, and each minute has 60 seconds. A day, then, has 24 hours, 1,440 minutes, or 86,400 seconds. This is the 'solar day' (see page 1978), calculated by the time it takes for the Earth to complete one whole rotation around its own axis.

The rotating Earth revolves in a slightly elliptical orbit about the Sun, from which it keeps an average distance of about 93 million miles (see page 1978). The time which the Earth takes for one such revolution fixes the length of the year. During the time of one orbit the Earth rotates on its axis approximately $365\frac{1}{4}$ times, thus determining the number of days in a year (see page 1996).

When the Earth is in this position it is the *spring equinox* (21st March). The line which separates the illuminated zone from the zone in darkness passes exactly through the poles: day and night are the same all over the Earth – 12 hours.




THE LENGTHS OF DAY AND NIGHT IN THE FOUR SEASONS

The Earth is in this position in its revolution around the Sun at the *winter solstice* (21st December). If we compare the broken red lines which pass through the northern and southern hemispheres we will see that in the northern hemisphere the night is longer than the day – it is winter, while in the southern hemisphere it is summer – and the day is longer than the night.

# FORMOSA

'AN unsinkable aircraft carrier off the coast of China' – this is an American view of Formosa, or Taiwan (to give it its official Chinese name), the island separated from the mainland of China by a shallow strait about 100 miles wide. Shaped like a tobacco leaf, Formosa is about 235 miles from north to south and about 90 miles from east to west at its broadest point. Included in Formosa's territory are the Penghu Islands or Pescadores in the Formosa Strait and a number of very small islands close to the mainland, notably Quemoy which in the past has been subject to Communist shelling. Under the leadership of Generalissimo Chiang Kai-shek (see page 1283), the government of Formosa claims to be the official Chinese government and it sits in this capacity in the Security Council of the United Nations.

## Mountains

Formosa is dominated by a lofty, forest-covered range of mountains which stretches almost the whole length of the island. The highest peak, Tung Shan, is over 13,000 feet high. In the north-east the mountains drop in steep cliffs of 1,500 and 2,000 feet to the Pacific Ocean. Farther south they are broken by the Taito Lowland which is separated from the eastern coast by a narrow range of lower hills. On the western side of the island the mountains slope more gently and are separated from the sea by a broad, fertile plain. This western plain is the main agricultural region and also the most densely populated part of the island.

## Monsoons

Although only the southern half of Formosa lies within the tropics, warm winds and sea-currents ensure that nearly the whole of the island enjoys tropical heat. Nevertheless, there is considerable local variation in climate. During the summer the south-west monsoon brings heavy rain, largely in the form of thunderstorms, to the southern two-thirds of Formosa. This part also has frequent destructive typhoons. But the north, which is sheltered from these rain-bearing winds, is dry in summer. In winter the dominant wind is the north-west monsoon. It brings dull, wet weather to the northern third of the island but is dry and warm by the time it reaches the south.



A Nationalist Chinese soldier




Geographical position of Formosa

An aborigine of Formosa dressed in traditional costume

The steep, forested cliffs of Formosa's Pacific coast are one of the difficulties facing the road builder

### THE PEOPLE

The retreat of Chiang Kai-shek's Nationalist Army from the mainland in 1949 brought an influx of some 1½ million soldiers and civilians to Formosa. In that year the population was over 7 million; today it is over 11 million. If it continues to grow at this alarming rate the island will soon be unable to supply sufficient food for its population. The vast majority of the people are Chinese, but over 100,000 aborigines – descendants of the original native inhabitants – still remain. Most of them live in the mountain forests where they eke out a meagre existence by hunting and primitive farming. They are extremely backward, and cases of head-hunting were recorded as recently as the 1950s.

### FACTS AND FIGURES

**Area:** 13,890 square miles
**Population** (1962): 11,375,085
**Density of pop.:** 780 per sq. mile
**Towns:** Taipei 963,640
Kaohsiung 275,600
Tainan 229,500
Taichung 207,000
**Imports:** Machinery, vehicles, crude oil, raw cotton, wheat, and flour.
**Exports:** Sugar, pineapples, bananas, vegetables, tea, rice, timber, textiles, and cement.

## Agriculture and fishing

Although most of the people of Formosa depend directly on agriculture for their livelihood, only a quarter of the island is under cultivation – the rest is too rugged. The principal food crop is rice which is grown throughout the western plain and in the Taito Lowland in the east. Over half of this crop is cultivated in irrigated paddy fields which have to be kept flooded while the rice is growing. In many areas two crops are harvested each year, and some rice is exported, mainly to Japan. Other food crops grown largely for home consumption are sweet potatoes, cassava, maize, groundnuts, and wheat. Cattle, pigs, and ducks are kept on most farms.

The most important export crop is cane sugar which is cultivated in the southern two-thirds of the island. More than 2 million tons of cane sugar are sent abroad every year, most of it going to Japan. Pineapples, bananas, and tea – grown on terraced slopes in the north of the island – are also valuable export crops. Citrus fruits, tobacco, peppermint, and mushrooms are grown, and citronella oil and camphor, both of which are used in the manufacture of perfume, are exported.

In recent years the government, which receives generous aid from the United States, has carried out a number of measures to increase farming efficiency. Attempts have been made to expand the area under irrigation, increase the output of hydroelectricity, conserve the water supply in the dry season, and control flooding in the rainy season. Government funds have also been used to buy fertilisers and pest-killers. Home food production has been increased, but this has been achieved largely at the expense of export crops such as cane sugar and fruit. It seems likely that, because of the rapidly increasing population, there will be a major food-supply problem in Formosa in a few years' time.

The fishing industry has been steadily growing during the last ten years, and fish are now an important element in the local diet. Tunny fish are exported to the United States.

*A typical country scene – small terraced fields are separated by mudbanks, and some are flooded for rice*

*DID YOU KNOW?*

1. *It is possible that there may still be head-hunters in Formosa.*
2. *The Nationalist Chinese Army now numbers about 400,000. Since it retreated to Formosa it has been reorganised, re-equipped, and trained by the United States who also helped to re-equip the Nationalist Air Force.*

## Trees and animals

More than half of Formosa is covered with thick forests containing a great variety of trees. Rising from the cultivated lowlands is a broad belt of deciduous forest with palms, banyans, cork oaks, cypresses, and sandalwood trees. Wild rhododendrons, orchids, and azaleas add vivid splashes of colour to the green of the forest. Above 6,000 feet dense woods of pine and fir cover all but the highest peaks. In the past uncontrolled felling of trees caused soil erosion, but today forestry is carried out scientifically and timber is becoming an increasingly important export.

Formosa also has a great variety of wild animals including macaques, palm civets, deer, wild boars, and clouded leopards.

*A street in Taipei, the capital of Formosa – brightly coloured signs describing the wares for sale in shops and a remarkable absence of motor traffic are striking features of this city*

## Industries

Despite its small size, Formosa is an important industrial and trading nation. Its considerable mineral resources include coal, petroleum, gold, copper, silver, and salt. More than 4½ million tons of coal are mined each year at the Chilung coalfield, and there is a huge gold mine at Changhua. Food processing and textile manufacturing have expanded in recent years, although the raw materials for the textile industry have to be imported. The fertilisers which are so vital to the country's agriculture are also manufactured on a large scale, and over 1½ million tons of cement are produced each year. Other products include fuel and oil, iron and steel, aluminium goods, machinery, ships, pulp and paper, chemicals, and glass.

## Towns

Formosa has few large towns considering the density of its population. The capital, Taipei, lies at the northern end of the western plain and is the only large city. It is in many ways a typical Oriental city with its curious blend of Asiatic and modern American influences. The other major towns are Tainan, Kaohsiung, Taichung, and Chilung which is the port for Taipei.

### HISTORY

Chinese colonisation of Formosa began in the 15th century, but a firm link with the mainland was not established until 1683, when the island came under the control of the Manchu dynasty (see page 1282). The development of the western plain continued for the next two centuries, but Formosa's ports were not opened to foreign trade until 1860. After the war between China and Japan (1894–1895) the island became part of the expanding Japanese empire. The occupation was, on the whole, beneficial, for the Japanese opened up the east coast, built roads and railways, and increased agricultural production. But the conquerors did not settle in Formosa in large numbers. The island was mainly useful to them for supplying rice, sugar, tropical fruits, and other products.

In 1945, at the end of the Second World War, Formosa once more became part of China, and Japanese settlers had to return to their own country. Since 1949 Formosa has become in effect a separate country.

# LIFE IN A MEADOW

GO for a walk through a wood and keep your eyes open. If you do not make too much noise you will almost certainly see a variety of animals, such as squirrels, lizards, and birds, and hear the murmuring of insects. But what would you expect to see if you left the wood and walked across a meadow?

Many people think that there is not much life in a meadow, except for a few butterflies hovering above it and an occasional bird flying overhead. But, if you are prepared to look for it, you can find a great deal of animal activity there.

The perfect meadow for animal life is a hayfield, in which there are of course no sheep or cattle to eat down the grass and flowers. It should be bounded on one side by a wood, and on the others by hedges. A footpath skirts round two sides of it; at one point this path should run past a pond which is deep in the middle but shallow, with a thick growth of rushes near the edges. In a meadow of this kind you can see a great deal of animal life if you walk slowly and quietly, watching the grass and flowers at your feet and the taller plants and bushes that form the hedges.

Nearly all the animals you find in the meadow will be invertebrates – that is, animals without backbones – and most of them will be insects. Of course there will be birds flying over the meadow, and a few, such as skylarks, may be nesting in it. There will be mice living in the grass, but you are not likely to see them.

A few of the invertebrates you see in the meadow may be of the same kinds as you would see in a wood, but the majority will be of different species – insects which feed on grass, clover, or other plants that do not grow well under trees, and insects which themselves thrive better in open sunshine than in the shade. A few of these meadow insects are shown in the large illustration.

*Some of the insects and other*

## Meadow invertebrates

On the grass stems near the path you may find some curious, pale-yellow, spindle-shaped objects, about 1 inch in length (1a). Near one of them is a small, brightly coloured moth, its fore-wings a shining blue-black with six bright red spots. This is the six-spot burnet moth (1b), and the yellow objects are cocoons of this insect.

As its name implies, the meadow brown butterfly (2) is one of the most characteristic insects of grassy places. The caterpillar feeds on various grasses, and the butterfly is seen in July. The small heath (3) is another common butterfly of meadows and grassy roadsides.

The damsel-fly (4) will probably be found near the pond, as its early stages are spent in the water. Damsel-flies are closely allied to dragon-flies, but they are much more slender and less powerful in flight. They live on flies and other small insects.

The clouded yellow (5) is a beautiful butterfly that is generally found in meadows where there is plenty of clover growing. In some years it is fairly common, but in others it is scarcely seen at all. It migrates to Britain from southern Europe, but this migration is quite irregular and in some years hardly any of these butterflies come to Britain.

Bumble bees (6) are seen wherever there is bright sun and a number of flowers. They are very useful insects, as they carry the pollen of clover from one flower to another and so enable the plants to produce seed.

If you search on the ground between the blades of grass you may find some wolf spiders (7). These spiders do not spin webs but hunt insects by stalking and pouncing on them.

The darter dragon-fly (8), like the damsel-fly, spends its early stages in the pond, but its powerful flight often takes it far from the water. Both the aquatic larva and the dragon-fly itself capture and eat other insects.

Hover-flies (9b) will be seen hovering in the air or sitting on flowers along the edge of the meadow. Their larvae (9a) live on the leaves of trees and shrubs and feed on green-fly, and they are therefore very useful insects.

Grasshoppers (10) are the most characteristic of all meadow animals, and their chirping song is one of the most pleasant sounds of

*invertebrate animals that are found in and around meadows*

summer. They make this sound by drawing a row of minute teeth on one hind-leg across a ridge on one fore-wing.

Several kinds of 'blue' butterfly are found in Britain, but the only one found in large numbers is the common blue (11). Its caterpillar feeds on clover and trefoil, and the butterfly is seen throughout the summer. Only the male is bright blue; the female is mainly dark brown.

Soldier beetles (12), so called because of their bright-red colour, are always to be found in summer sitting on the flowers of umbelliferous plants such as hog-weed.

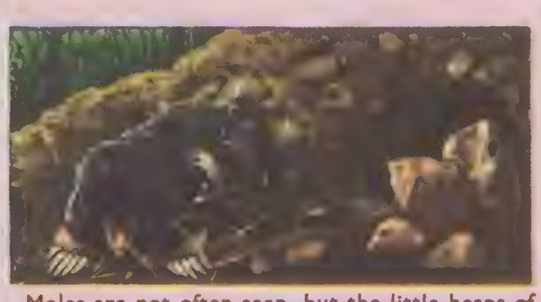
The crane-fly or daddy-long-legs (13) appears, sometimes in great numbers, in late summer and autumn. It is a clumsy, unattractive creature. Its larva or grub, known as the leather-jacket, feeds on the roots of grass and does a great deal of harm to hay and pasture.

The wasp-beetle (14) is not very common, but it is a handsome insect and well worth looking out for. It is usually found on umbelliferous flowers in company with soldier beetles and hover-flies. It is thought that its resemblance to a wasp may protect it from attack by birds.

Snails (15) of various kinds are common in the meadow and in the thick herbage of the hedges and the border of the wood. Most of them stay hidden by day and come out at night to feed on the young leaves of grass and herbs, but they are seldom plentiful enough to do much harm.

The ladybird (16) is a very attractive little beetle; both the larvae and the beetles themselves feed on aphids or greenfly and, like the hover-flies, are real friends of the farmer.

Earthworms are among the most abundant inhabitants of the soil; there are often several tons of them beneath an acre of grassland. The worms do a great deal to make the ground fertile. They drag leaves and other vegetable matter into their burrows, and also help to make the soil permeable to water by burrowing deeply into it.



Moles are not often seen, but the little heaps of earth that they throw up are quite common. The mole is highly adapted for digging; its forepaws are very powerful and armed with strong claws. Moles feed largely on earthworms and consume great quantities of them.

# THE BORDER COUNTIES

*The heather-covered Lammermuir Hills, on which graze some of the sheep whose wool is used to make the famous tweeds of the Border Counties*

THE counties along Scotland's border with England were a battle-ground for centuries. The Romans fought against the Picts; the Scots and the English fought each other; even the border clans warred among themselves. And as a result the region is studded with forts, defence towers, and castles which were built over the centuries. The border has been peaceful now for some 200 years; but these ancient buildings are an ever-present reminder of the troubled past.

The border between Scotland and England runs from Solway Firth north-east through the Cheviot Hills to the mouth of the river Tweed. Three Scottish counties lie along it; from west to east they are: Dumfriesshire, Roxburghshire, and Berwickshire. They are predominantly hilly; and on these hills graze thousands of sheep. As a result the Border Counties are famous for the woollen cloth woven there, and the industries of the district are mostly associated with wool.

## Dumfriesshire

Dumfriesshire, the most westerly of the Border Counties, has an area of 1,073 square miles. It is dissected by three great valleys – Nithsdale, Annandale, and Eskdale – which take their names from three rivers flowing south from the wild, rocky hills in the northern half of the county. The land slopes south to Solway Firth, and in the lower parts the soil is very fertile. Oats, turnips, and potatoes are the main crops. Dumfries, the county town, is a market centre for the surrounding region and a flourishing wool town.

Since the Second World War new industries have been started in the county in addition to those based on wool. Milk is dehydrated and canned near Dumfries, and rubber boots and flooring are made there. At Annan are hosiery and engineering works, and chipboard is manufactured. Many women work in the wool industries, and there are commercial salmon fisheries on the Nith, the Annan, and Solway Firth. But despite these industries the county is still essentially an agricultural region.

The early inhabitants of Dumfriesshire have left behind hill forts, mounds, and stone circles. The Romans built roads and camps there, for the main western route to the north runs through the county. Forts and castles were built in the centuries of fighting between Scottish and English, among them Robert Bruce's castle at Lochmaben, and Caerlaverock which was besieged and captured by Edward I of England in 1300.

The most famous – or perhaps notorious – place in Dumfriesshire is Gretna Green which lies just over the border from England. It is renowned as the nearest place to England in

*DID YOU KNOW?*

1. *Tweed, which is woven extensively in the Border Counties, was originally called tweel. It is suggested that its name was changed by an English clerk, who thought the cloth should be called after the great river Tweed.*
2. *The Coldstream Guards were raised at Coldstream in Berwickshire by General Monck in* 1660.
3. *In* 1745 *Prince Charles Edward received* £2,000 *and* 1,000 *pairs of shoes for his soldiers from the burgh of Dumfries.*

which people can take advantage of the comparatively lenient Scottish marriage laws. It is now a tourist centre as well as a focus for eloping couples not just from England but from all parts of Europe.

*The ruins of Jedburgh Abbey, which was founded by King David I*

## Roxburghshire

Roxburghshire, the middle of the three Border Counties, has an area of 665 square miles. In the south are the wild Cheviot Hills, and across the middle of the county runs the river Teviot, which flows east to join the river Tweed. Both these rivers contain many trout and salmon.

More than half of Roxburgh is rough grazing for sheep. The largest ram sales in Scotland are held at Kelso each September, and great numbers of sheep are sold at Hawick in the Teviot valley, one of the largest border towns. The old town was burned in 1418 and again in 1570, and little remains of it today. Hawick is now famous for its manufacture of woollen goods, and has other industries, like dyeing, which are associated with wool.

In the north of the county are the Eildon Hills. According to an old fairy tale Thomas the Rhymer, a 13th-century prophet and poet, lived here for seven years with the Queen of Elfland.

Roxburghshire belonged to Northumbria for four centuries but was ceded back to Scotland in 1018. It was made a shire by King David I who founded abbeys at Kelso (1128), Jedburgh (1147), and Melrose (1136) where the heart of Robert Bruce is buried. The ruins of Melrose are described in Sir Walter Scott's poem *The Lay of the Last Minstrel*.

The old town of Roxburgh was completely destroyed by James II of Scotland in 1460, and the present village of that name stands a little south-east of its site. The county town is now Jedburgh.

## Berwickshire

This is the smallest and most easterly of the three Border Counties and has an area of only 457 square miles. Part of the border is formed by the river Tweed, but Berwick-upon-Tweed rather surprisingly belongs to England and not to Scotland, although it lies on the north bank of the Tweed. Its strategic position made it a centre of strife, and between 1147 and 1482 it changed hands 13 times. The town itself did not want to be included in either country and used to be mentioned separately, after Wales, in Acts of Parliament.

The coastline of the north-east of the county is rocky, and there are fishing ports at Eyemouth and Burnmouth. Eyemouth used to be a great smuggling town, and it is said that at one time it had more underground tunnels than streets.

In the north of the county are the grass- and heather-covered Lammermuir Hills, which are grazed by countless sheep and contain many ancient hill-forts and defence towers. The river Leader – the valley of which is called Lauderdale – rises in the Lammermuirs and runs south to form the western boundary of the county.

In the south-east of Berwickshire is a lowland region, the Merse, which is very fertile and has large farms. The river Tweed meanders through it in a beautiful valley. Agriculture is the main occupation of the population, though there are commercial salmon fisheries on the lower part of the Tweed and woollen manufacture at Earlston and near Duns, the county town. Textiles are processed at Lauder and Duns, and at Eyemouth fish are cured and a little boat-building takes place. There are, however, no large towns in the county, and Berwick-on-Tweed is still the main commercial centre of the area.

Just north of Duns, at Cockburn Law, is the oldest building in the county – a ruined *broch* or circular tower, built by the Picts. At Coldingham, in the north-east, there was once an abbey founded in the 7th century by St Ebba. The Benedictines built a priory here in the 11th century, but this was badly damaged in the 16th and 17th centuries.

*Map of the Anglo-Scottish border*

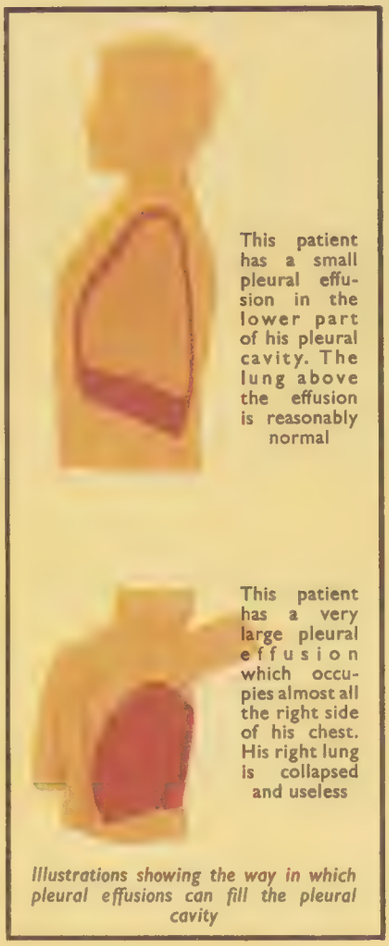
## Scott's country

The Border country has been immortalised by Sir Walter Scott (see page 293), who made it the setting of several of his novels and poems, and who collected the ballads which tell its colourful history in his *Minstrelsey of the Scottish Border*. He built himself a magnificent house, Abbotsford, in the heart of the country he loved so well.

# PLEURISY

EACH time a man draws a breath approximately 500 millilitres of air flows down his windpipe into his lungs. When the breath is expired this air, richer in carbon dioxide but poorer in oxygen, flows gently out again. At rest this cycle of inspiration and expiration is repeated 16 to 20 times each minute (see page 2480), but when strenuous exercise is taken not only does the rate of respiration increase but so, too, does the depth. In very deep breathing the amount of air taken into the lungs at a single breath may be as great as 3,000 millilitres, the equivalent of approximately 6 pints.

During each inspiration and expiration, particularly if they are large, there are marked changes in both the size and shape of the chest cavity. This means that if the lungs are to adapt themselves to fill the chest cavity all the time their outer surfaces must be able to slide smoothly on the inner surface of the chest wall. This is just what happens, and it is made possible by the existence of a wonderful double-layered membrane called the *pleura*, or *pleural membrane*, which surrounds each lung.



This patient has a small pleural effusion in the lower part of his pleural cavity. The lung above the effusion is reasonably normal

This patient has a very large pleural effusion which occupies almost all the right side of his chest. His right lung is collapsed and useless

*Illustrations showing the way in which pleural effusions can fill the pleural cavity*

## The pleural membranes

Imagine that each of these double-layered pleural membranes is a football bladder which has been emptied of air. Place your closed fist on the bladder, and with your other hand manipulate the bladder into a bag, so that your fist is almost entirely surrounded by two layers of rubber in contact with each other. The outer layer of the rubber bladder corresponds to the *parietal pleura*, the outer layer of the double pleural membrane which is firmly fixed to the inner wall of the chest cavity. And the inner layer of the bladder corresponds to the *visceral pleura*, the inner layer of the pleural membrane which is everywhere attached to the surface of the lung. At the edge of the 'bag' the parietal pleura and the visceral pleura merge. Your fist corresponds to the lung which is almost entirely surrounded by this double layer of pleural membrane.

In a healthy person the parietal and visceral layers of the pleura are in close contact with each other. Between them there is only a very small amount of clear fluid which makes it possible for the two layers to slide comfortably upon one another. This sliding action is of the greatest importance, for as a result of it the lungs are able to follow the changes in size and shape of the chest cavity and thus fill the cavity completely at all phases of respiration. Every movement of the chest wall is accompanied by a corresponding change in the size and shape of the lungs. In this way efficient respiration is assured.

## Inflammation of the pleural membranes

Lying as they do beneath the protective ribs, the pleural membranes seldom suffer damage from outside. Only serious injuries such as stab wounds and gun-shot wounds constitute a threat to them. The visceral layer of each pleural membrane, however, is very closely attached to the surface of its lung, and it is therefore not surprising that diseases which affect the lung tissue frequently spread outwards and affect the adjacent pleura.

Inflammatory conditions of the lungs such as bronchitis and pneumonia are those which most commonly spread to the pleurae. The inflammation affects both the parietal and visceral layers, and it is this inflamed condition of the pleural membranes which is known as *pleurisy* The most characteristic symptom of pleurisy is the sharp pain which is experienced each time a breath is taken.

## Two kinds of pleurisy

In a mild attack of pleurisy the inflammatory changes merely cause reddening and roughening of the two pleural membranes. This prevents the membranes from sliding on each other in the proper way and, in consequence, gives rise to the sharp pain which is felt each time the patient breathes. Very often the doctor who examines a patient with pleurisy can actually *hear* the sound made by the membranes as they rub against each other.

In a serious attack of pleurisy the membranes not only become inflamed but pour out a fluid which accumulates between the parietal and visceral layers. This fluid is pale yellow and is known as a *pleural effusion*. Should the pleural effusion become very large, it can occupy so much of the chest cavity that the lung on that side is compressed and put out of action. The existence of a pleural effusion is not difficult to diagnose, and its shadow can easily be seen on an X-ray picture of the chest like the one shown in the illustration below.

## The treatment of pleurisy

Mild attacks of pleurisy, without any very obvious cause, are not uncommon, and in such cases very little treatment is needed. Rest in bed, fresh air, and a good diet often seem to bring about a spontaneous cure.

In the more serious attacks of pleurisy, associated with disease of the lungs, the treatment is usually directed at the lung condition. When this is cured the pleurisy gets better by itself. Thus pleurisy associated with pneumonia (see page 2890) is cured when the pneumonia is treated with antibiotics. In cases where there is a large effusion, however, this may have to be drained away before the patient can make a complete recovery.

*This X-ray picture of a human chest shows a pleural effusion at the base of the left lung*

# THE TRANSFORMER

*A simple experiment which demonstrates the principle of the transformer*

LOOK at the illustration on the left. You will see a light bulb attached to a ring of wires held in a man's hand, and this bulb is lit. Where does the electricity come from to light the bulb? Obviously it cannot come from a battery or dynamo, because the ring of wires is not attached to anything. The answer is that the *electromagnetic field* (see page 2126) of the iron bar which stands in the centre of the ring of wires *induces* a current in the wires and so lights the bulb. But why should the iron bar have an electromagnetic field? This is caused by an alternating electric current (see page 2794) flowing through the spiral of wires which have been wound around the lower part of the iron bar.

To use an electrical current in one wire to produce an electromagnetic field and thus induce a similar current in another wire is an interesting experiment, but it has little practical use. However, by arranging the wires in a particular way it is possible to modify the electromagnetic field and produce an induced current, or *output*, which has very different electrical characteristics from the original, or *input*, current. This is what happens in a *transformer*, the very important device with which electrical engineers can convert low-voltage electricity supplies into high-voltage supplies, and high-voltage supplies into low-voltage ones suitable for domestic and industrial use.

## Building transformers

Transformers made today vary in size from the tiny ones used in the miniaturised electronic equipment of spacecraft to giants which can handle all the electricity needed for a small town. In spite of these great differences in size, however, all transformers are designed according to the principle demonstrated in the experiment with the iron bar.

The central metal part or *core* of a modern transformer is made not out of an iron bar but out of a large number of thin strips of special steel, all varnished for insulation and held together with insulated bolts. Very often the core is square-shaped, like the one shown in the diagram below, but in some transformers much more complicated shapes are used either to save space or to provide greater efficiency.

The wires which carry the input current are wound around one side of the core and they are known as the *primary windings*. The wires in which the output current is induced are wound around the opposite side of the core and are known as the *secondary windings*. Transformers with more turns in the secondary than in the primary windings are called *step-up transformers* because they provide an output of higher voltage than their input. Transformers with fewer turns in the secondary than in the primary windings are called *step-down transformers* as their output voltage is lower than their input.

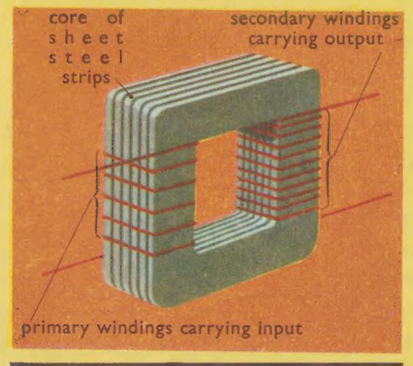



*Diagram of a transformer*

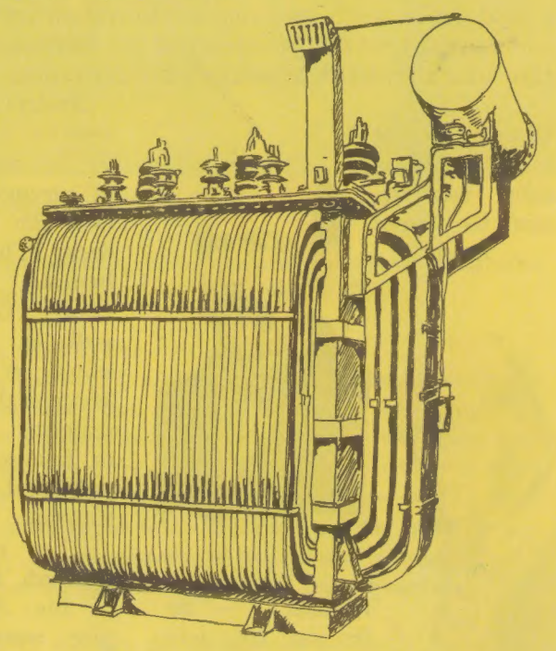
Small transformers are often supported merely on metal frames, and the windings are left uncovered. Others are fitted into small metal or plastic boxes which provide protection against damage. Large transformers are usually housed in oil-filled tanks. The oil absorbs the heat which is generated while the transformer is working and dissipates it through tubes on the outside. In this way the core and windings are kept cool. Some large transformers, however, produce more heat than can be removed conveniently in this way and so they have to be provided with electrically driven pumps which circulate the oil through radiators to keep it cool.

## The uses of transformers

In almost every home there are several small transformers which are used to step down the 240-volt domestic electricity supply to low voltages suitable for appliances like electric door bells (see page 2858), motor-car battery chargers, and some types of electric blanket. There are also small transformers in all alternating current radio receivers and television sets.

Larger transformers are used in industry to provide the correct voltages for many types of industrial equipment, especially electric welding plant. Others are used on electric railways which employ alternating current. The largest transformers of all are among the many used by the Central Electricity Generating Board for stepping up voltage so that electricity can be carried economically through the Grid system (see page 2795), and later for stepping it down again to levels safe for industrial and domestic use.

*A large transformer designed to convert electricity supplies at 33,000 volts to 11,000 volts. The rows of tubes around this transformer form the radiator used to disperse the heat*



# HISTORY OF GERMANY (part three)

WHEN the 19th century began Germany was splintered into over 300 more or less independent principalities dominated by the two great Germanic powers, Austria and Prussia. Actually, Austria was only partly Germanic, for she had a vast empire which included Belgians, Italians, Magyars, and Slavs. There would clearly be a showdown one day between these two states for the leadership of Germany. In the 18th century Prussia had already made considerable gains at the expense of Austria, but because of Austria's huge empire and the prestige of the title 'Holy Roman Emperor' held by her Habsburg ruler, most people still considered her the dominant power in Germany. But what would happen if the German states wanted to become united? Clearly Austria, with her non-German empire, would never willingly allow this. So it came about that the hope of German nationalists rested on Prussia – in Prussia's ability to defeat Austria and impose unification by force.

The impetus towards nationalism came not from within Germany but from Napoleon (see page 2491). He drastically reorganised the country into only 39 states, abolishing the title of **Holy Roman Empire** and setting up the **Confederation of the Rhine.** Gradually the German people came to resent their conqueror. They saw that they were not merely Bavarian, Prussian, and so on, but also German, with a bond of language and culture they did not share with the French.

However, the **Congress of Vienna** nipped in the bud any premature ideas of German unity. It strengthened Prussia in Germany by giving her large areas of the Rhineland but enlarged the Austrian empire in Italy. 'Dualism' continued, and the basic problem of Germany – whether she would ever be wholly united and wholly Germanic – remained.

Due to the genius of Austria's **Metternich** (see page 2720) and the ineptitude of Prussian policy, Austria remained the dominant power in Germany after the Congress of Vienna. Prussia did indeed bind some German states closer to her by means of the *Zollverein* or 'customs union', but Metternich maintained a rigid police system to stamp out liberalism and nationalism; and Austria held the presidency of the **German Confederation** which replaced Napoleon's Confederation.

*Otto von Bismarck – the 'Iron Chancellor' who created the Second Reich*

*Wilhelm I – the Prussian king who became the first German emperor of modern times in* 1871

Austria's vast possessions which seemed to be such a source of strength were, in fact, the cause of her decay. The **1848 revolutions** which convulsed Germany, as well as Europe, resulted in the fall of Metternich, and demonstrations were held in favour of German unity and a liberal constitution.

The revolts were crushed, but the days of the Austrian empire were numbered. In 1859 and 1860 large areas of Italy freed themselves from Austrian rule, and in 1862 a new Prussian Prime Minister, **Otto von Bismarck** (see page 1332), came to power determined finally to establish Prussian supremacy in Germany.

In 1866 Bismarck completely defeated Austria. In 1871, after a further military triumph over France, Bismarck created a new German empire under Prussian control. This excluded Austria. Meanwhile, in 1867, Austria had remodelled her empire, giving the Magyars independence in the newly-created **Austro-Hungarian Empire.**

Bismarck's Germany – the **Second Reich** – was industrially and militarily powerful. But after Bismarck's fall in 1890 **Kaiser Wilhelm II** pursued a headstrong policy which resulted in an alliance of Britain, France, and Russia against him.

He kept a close alliance with Austria and supported her attempts to control the Slavs in her empire. But Slav discontent became greater and greater, and after the **First World War** (see page 2742) Austria was totally dismembered. New countries like Yugoslavia and Czechoslovakia were carved out of her territory.

The Habsburgs of Austria and the Hohenzollerns of Germany disappeared together as a result of the war, and republics were established in both countries. But discontent in Germany grew. Germans felt themselves harshly treated: they resented the annexation of Alsace-Lorraine by France, and they blamed their enemies for their numerous economic crises. Moreover, a demand grew for a new empire of all Germans, including those in other lands. Of this the leading spokesman was **Adolf Hitler,** leader of the National Socialist, or **Nazi,** Party. He became German Chancellor in 1933, and from then on Germany embarked on a terrible course of conquest.

The German republic was replaced by Hitler's *Reich* – the **Third Reich** – and the nation rearmed in preparation for war. The Rhineland was remilitarised in 1936 and Austria annexed in 1938. At last German 'dualism' was ended. But Hitler was far from finished. The same year he annexed the Sudeten Germans in Czechoslovakia and then occupied the rest of that country. Already he had formed a close alliance with his fellow dictator, Benito Mussolini, and had warned his General Staff to be ready for a full-scale war. His aim was not merely a united empire of Germans but a Europe under German control. On 1st September 1939 he invaded Poland, and on 3rd September Britain and France declared war in defence of Europe.

The **Second World War** (see page 2792) was a complete defeat for Germany, though at one time German arms had made conquests unparalleled in military history and had overrun most of Europe. After the war Austria once more became an independent republic, but Germany was split up into zones administered by the victorious allies. In 1949 the British, French, and American zones were united, and the West German **Federal Republic** came into being. The same year the Russian zone became the **'Democratic Republic'** with a Communist government. That remains the position of Germany today – the once-mighty German nation divided into East and West, aptly symbolising the division between the worlds of Communism and Democracy.

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The early ships of the Norsemen and of the Mediterranean peoples were galleys, with banks of oars rowed by galley slaves and with small square sails. They were well suited for warlike voyages in the Mediterranean, but they were less than adequate for long voyages across the Atlantic and even for the carriage of freight. Slowly they were replaced by the sailing ships which, under the command of men like Columbus, were to sail across the oceans and reach lands of which Europeans had never dreamed.

## The ships which discovered the world

As long as the square sail of the galley remained in use ships could only take advantage of the wind when it blew directly from astern. In about the 9th century A D the triangular or *lateen* sail was introduced. This was a great advance, since it now became possible for ships to sail across the wind. At the same time large areas of the ships were decked in, which made them much more seaworthy. But for several more centuries ships had only a single mast, and only in the 15th century was a second mast, and later a third and fourth, introduced. Often, as in the vessels known as *carracks*, the fore and main masts were rigged with square sails and the mizzen (aftermost) mast lateen rigged.

The combined effects of the improvements in shipbuilding in the 15th century and the improvements in methods of navigation which were also made at this time were so great that ships of the leading maritime nations – Portugal and Spain – were able to undertake voyages of many weeks' duration. Portuguese sailors explored the west coast of Africa, and in 1488 Bartholomew Diaz was the first man to round the Cape of Good Hope and enter the Indian Ocean. He was followed in 1497 by Vasco da Gama, who sailed as far as India in his search for gold, silk, and spices.

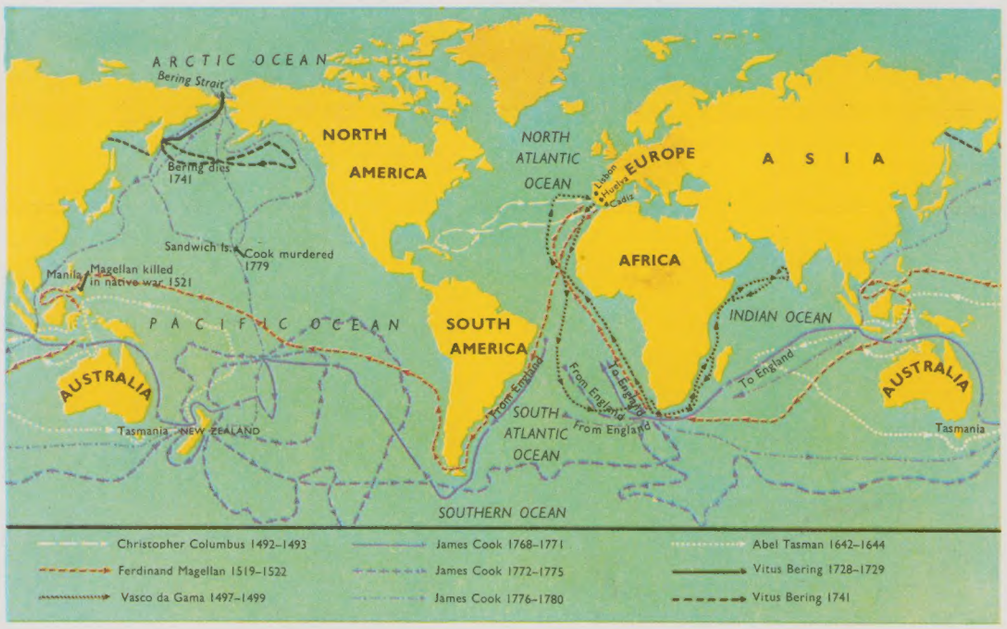
The search for spices in particular was one of the chief incentives for the early explorers.

The Spice Islands were in the Indian Ocean, and the journey round the Cape of Good Hope was extremely hazardous. While Columbus was trying to discover another route to these islands, by sailing westwards rather than eastwards, he landed his little flagship *Santa Maria* on the other side of the Atlantic. It was not the Indies which he found in 1492, but a far greater prize – the New World. The westward route to the Spice Islands was not discovered until 1520 when Ferdinand Magellan found a passage round South America and across the Pacific Ocean.

## The Tudors and the Navy

Although there were many English ships before the 15th century and Richard Coeur de Lion mustered 120 for a crusade, they were chiefly small vessels and could in no way compare with the magnificent ships of Portugal and Spain. But Henry VII, who came to the throne in 1485, realised the value of large ships for trading with countries far afield and for the defence of England. He ordered several great ships to be built, with high-towering *poops* (decks at the stern) and four masts like the galleons of Spain. The later Tudor sovereigns continued his work, so that when the Spanish Armada sailed up the Channel in 1588 there were 197 English ships to meet it. No less than 34 of these were 'Queen's Ships', as naval warships in those days were called.

After the Armada the Spaniards continued to use galleons, which were really very heavily armed merchantmen, to carry home the riches of the New World. England, however, used privately-built ships specially designed for carrying merchandise and defended these vessels with warships. Among the warships was the three-decked ship which carried guns on each deck; though there were modifications as time went by, this basic pattern remained unchanged for ships of the Navy until after Nelson's victory at the battle of Trafalgar in 1805.




*The voyages made by the great discoverers of the world*

## Steam, iron, and steel

Even before the battle of Trafalgar the first steamships had made their appearance. They had many advantages over sailing ships since they were independent of wind and tide, but their need to refuel at frequent intervals at first prevented them from being a serious challenge to sail. The fast *clipper* sailing ships remained the most rapid form of transport for many years, particularly for the thousands of emigrants leaving Europe for America, and for the carriage of tea from Foochow to the London Docks.

During the 19th century the steamships gradually became increasingly reliable, and more and more of them were built, first of iron, and then of steel. Metal gave equal strength for less weight

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# Knowledge

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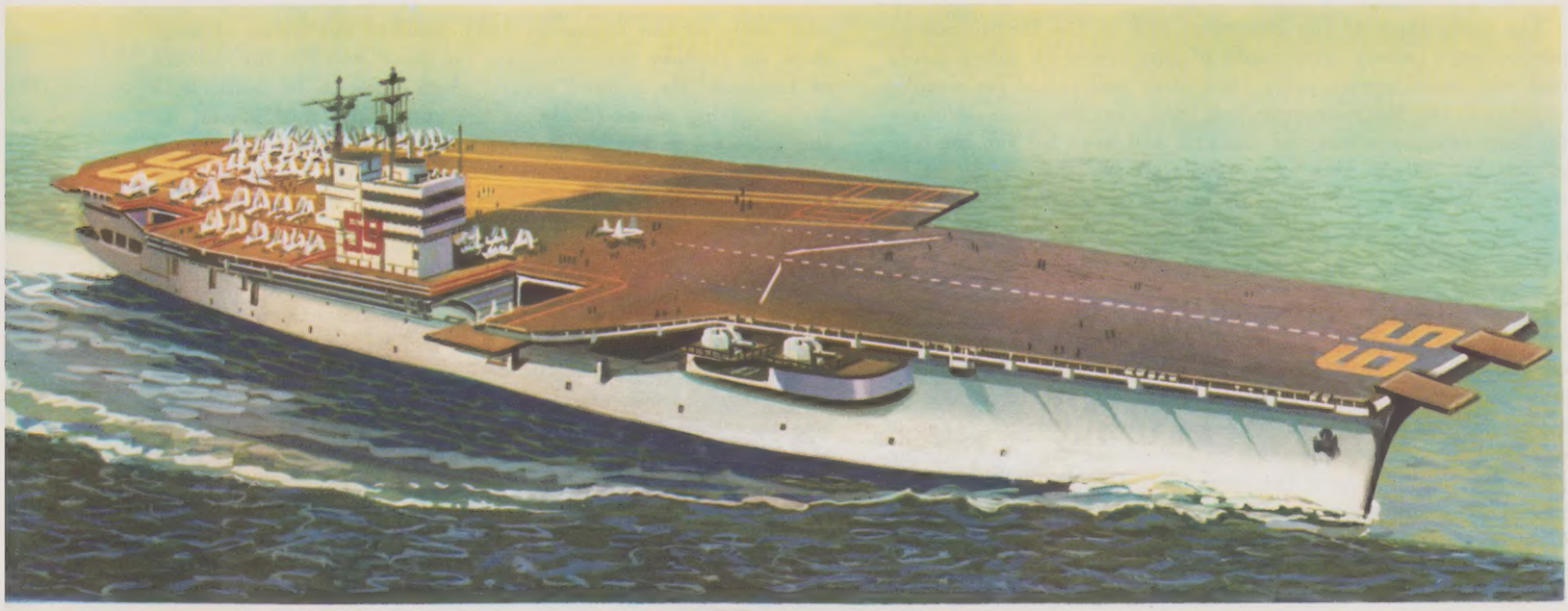

*The enormous American aircraft carrier* Forrestal. *The arrangement of her decks permits simultaneous landing and flying off by her aircraft*

than wood, and thus increased the ships' carrying capacity. In 1881 the first steel-hulled ship crossed the Atlantic.

Developments also took place in the steam engine, and the speed of the steamship steadily increased until it reached the 30 knots attained by the great liners of today.

## Naval and mercantile today

The distinction between warship and merchant ship which assumed such importance at about the time of the Armada has been maintained ever since by reason of the very different functions and equipment of these two kinds of vessel. The function of the warship today is chiefly to police the world's trouble spots and to carry the nuclear deterrent beneath the waves (see **Defence**). The function of the merchantman is to carry passengers and goods profitably.

The ship is still the cheapest – though not the fastest – method of transport for the carriage of passengers and cargo across the world. Where cargo is the chief interest the ships are built with large derricks to handle the freight and with uncluttered decks to make loading and unloading of cargoes easier. Passenger liners have no need of large derricks and holds, and their decks are built up to provide cabins and recreation space for the passengers. They also have a boat deck to carry the many lifeboats needed.

On some routes there are not enough passengers or cargo for separate liners and cargo ships to be economical. In these circumstances ships which carry a limited number of passengers as well as freight are often used.

The most useful warship for policing the world today is the aircraft carrier. Her aeroplanes and helicopters can range far from the decks of their parent craft, and there is enough space on board to carry marines, who can be landed by air in 'trouble spots' at a few hours' notice.

THREE TYPES OF MODERN MERCHANT SHIP

*A mixed-cargo ship*

*A combined cargo and passenger ship*

*A modern liner*